

## Introduction

An intensive programmatic lessons learned (PLL) Program implemented by the Project Manager for Chemical Stockpile Disposal (PM, CSD) has resulted in safer, more effective, and more efficient destruction of the U.S. chemical weapons unitary stockpile.

The PLL Program is designed to benefit diverse users including plant managers, operators, maintenance workers, public affairs staff, and others. Participants gather lessons learned from multiple sources, disseminate them, and track the issues so that required actions can be taken.

PLL Program results have been demonstrated throughout the PM, CSD effort. The Johnston Atoll Chemical Agent Disposal System (JACADS) team, which has destroyed 100 percent of the JACADS chemical weapons stockpile, worked 392,000 hours without a lost-time injury during a recent campaign. During the same campaign, the site's recordable injury rate (RIR), which compares the number of injuries per man-hours worked, was much lower than that of agricultural chemical factories (0.90 at JACADS versus 5.3 at the factories). As of February 2001, construction of the Pine Bluff Chemical Agent Destruction Facility exceeded 2.2 million man-hours without a lost-time accident.

The impact of the PLL Program is best demonstrated in the difference between early sarin (GB) rocket campaigns at the prototype facility, JACADS, and the Tooele Chemical Agent Disposal Facility (TOCDF), the first production site. At the time of each campaign, each facility was fairly new and had comparable workforces and equipment. Using lessons learned from JACADS (which began operations in 1990), TOCDF had demonstrably better performance and safety records. The RIR fell from 6.79 at JACADS to 3.68 at TOCDF. The disposal rate in terms of rockets per year increased from 5,206 to 11,472. In addition, days of environmental compliance-required shutdown fell from 11 at JACADS to 0 at TOCDF.

Building on these results, PM, CSD has continued its commitment to the PLL Program and has successfully instituted a lessons-learned culture.

## Program Methods

PM, CSD developed the PLL Program in 1992 to meet the technical, managerial, and geographic challenges

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# SAFER DISPOSAL OF U.S. CHEMICAL WEAPON STOCKPILE

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involved in safely destroying the U.S. unitary chemical weapons stockpile. The stockpile included 31,496 tons of sarin, mustard gas, lewisite, and other chemical agents stored at eight sites across the United States and on Johnston Island, 825 miles southwest of Hawaii. PM, CSD's mission includes the safe and environmentally sound destruction of chemical agents and industrial chemicals contained in a variety of rockets, projectiles, bombs, mines, and bulk containers.

In addition to dealing with the different containers, PM, CSD had to be prepared for dealing with unpredictable chemical agents. After being in storage for decades, some of the liquid munition fills had either crystallized or become a thick sludge. Other agents had degraded, creating pressurized gas in their containers.

To meet these and other challenges, the U.S. Congress required lessons learned at the prototype demilitarization facility be transferred to subsequent facilities. To expand on that direction, PM, CSD initiated a program to capture the lessons learned at all the PM, CSD facilities and forward them to future and, on occasion, to earlier sites. The purpose of the program was to pass along best practices, reduce the likelihood of mistakes being repeated, and to enhance safety and efficiency as the project expanded. PM, CSD worked with its integration contractor, Science Applications International Corp., to develop the program. As the *Site Programmatic Lessons Learned Program Plan* states, PM, CSD's goal is to ensure that experience gained by one site "was not lost as a result of organizational

boundaries, geographical separation, or the passage of time."

To achieve this goal, PM, CSD designed the PLL Program to transmit information via several methods, including the following:

- *PLL Database.* This comprehensive, searchable database stores and links issues that have been raised at meetings, workshops, etc. Streamlined issues that contain related information allow for greater flexibility and speed in searching the database. A distributable CD-ROM version can be supplemented with biweekly electronic file transfers.
- *Quick React.* For rare cases in which operational safety or environmental protection might be affected, the Quick React system immediately transmits information to affected program participants via facsimile.
- *Workshops.* These venues provide an opportunity for experts from each facility as well as PM, CSD to exchange lessons learned and give their input on issues.
- *Engineering Change Proposal (ECP) Review Process.* This process is designed so that each site can review other sites' ECPs and adopt any that are applicable.
- *Technical Bulletin.* The PLL Team publishes a quarterly bulletin with information that is valuable to program participants but does not need the peer-review aspects of workshop discussions.
- *Operational Assessments.* Studies and analyses have been performed on issues that demand in-depth research. Assessments to date have resulted in improvements to the safety culture at sites, an analysis of how to better track



*Automated equipment removes explosives from a weapon.*

munitions, and an evaluation of environmental permit-compliance history.

- *Programmatic Documentation.* Experience gained has been distilled and incorporated into programmatic documentation such as the *Chemical Demilitarization Operations Manual* and the *Guide to Emergency Response Planning*. Users can now refer to the electronic versions of these documents and use their hypertext capabilities to quickly link to the detailed information they need.

- *PLL Board.* Issues that exceed the authority of the PLL Coordinator or PLL Team are presented to the PLL Board (chaired by the project manager), which then decides on the issue. The PLL Team then disseminates the information.

The PLL Program has aggressively implemented these methods. In the last 2 years alone, more than 75 workshops have taken place; 244 issues have been collected and disseminated; 677 directed actions, which require sites to provide additional information necessary to close an issue, have been issued; and 1,664 ECPs have been recorded.

### **PLL Results**

The PLL Program has improved safety, efficiency, and efficacy throughout the PM, CSD mission. By tracking the changes in the fill compositions (when agent crystallizes or becomes a thick sludge), some of these variations can now be predicted by lot number, manufacturing location, and type of assembly. Information such as this was compiled into a stockpile tracking system, which in conjunction with lessons shared, ensures the most appropriate processing is performed.

The PLL Program assists in strategic planning (as with the modification of processing to react to fill composition changes) and in resolving issues that require immediate attention. When a JACADS worker received a caustic burn from a neutralizing agent because of an inner-glove failure of his demilitarization protective ensemble (DPE) in June 1996, JACADS officials used the Quick React system. They immediately warned other facilities about the glove failure and recommended the short-term solution of wearing an additional glove. Longer-term solutions involved investigating DPE lots that failed and securing improved glove materials.

Recent lessons learned also have led to important facility design changes. JACADS was designed to maximize operational efficiency; however, now as the JACADS Team begins closure planning, it has learned how the facility's dismantling could have been made easier had the original design taken closure into account to a greater extent. Doors could have been placed in different locations to ease equipment removal. Concrete could have been coated with a material that would block agent from seeping into it and prevent a time-consuming removal and treatment process. Using these JACADS ideas, designers of subsequent facilities have been able to better plan for each site's entire life cycle, cradle to grave.

Even much simpler changes can improve safety. For example, maintenance workers in DPE suits communicating with operators via radio now use "repeat backs." When told to open a certain valve, for example, the worker repeats back the command to ensure that the correct action is taken. Additionally, the PLL Program promul-

gated a solution for the backup personnel who stand by when colleagues enter an agent area. Wearing DPE, the backup personnel were forced to stand for their 2-hour shift because air bottles made it impossible for them to sit in normal chairs. After a team at the Chemical Agent Munitions Disposal System designed new chairs that accommodate the DPE, the PLL Team informed other sites of the chairs and their benefit in keeping backup personnel fresh and alert.

### **Conclusion**

The PLL Program has reached across government and contractor lines to help engineers, operators, warehouse workers, laboratory technicians, and others. PM, CSD has institutionalized communication and knowledge transfer throughout the effort to destroy the chemical weapons stockpile, ensuring that the process meets its primary goals of public and worker safety, environmental protection, and effectiveness.

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